



Mathematics and CS Seminar

Lexicographic optimal chains and manifold triangulations

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Dassault Systemes

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This talk will consist in three parts. In the first part we will describe algorithms for the computation of lexicographic minimal chains in an abstract setting. Given a simplicial complex K , we consider the problem of finding a simplicial d -chain minimal in a given homology class. This is sometimes referred to as the *Optimal Homologous Chain Problem* (OHCP). We consider here simplicial chains with coefficients in $\mathbb{Z}/2\mathbb{Z}$ and the particular situation where, given a total order on d -simplices $\sigma_1 < \dots < \sigma_n$, the weight of simplex σ_i is 2^i . In this case, the comparison of chains is a *lexicographic ordering*. Similarly, we consider the problem of *finding a minimal chain for a prescribed boundary*. We show that, for both problems, the same matrix reduction algorithm used for the computation of homological persistence diagrams, applied to the filtration induced by the order on d -simplices, allows a $\mathcal{O}(n^3)$ worst case time complexity algorithm. In the particular case where K is a $(d+1)$ -pseudo-manifold, there is a $\mathcal{O}(n \log n)$ algorithm which can be seen, by duality, as a *lexicographic minimum cut* in the dual graph of K . The second part will show how a carefully chosen total order on simplices allows to retrieve regular triangulations in euclidean spaces, as well as the triangulation of positive reach 2 -manifolds as the support of lexicographic minimal chains. We see that each part is motivated by the other. In a last part we will consider two open questions suggested by the preceding results. Results from a joined work with David Cohen-Steiner and Julien Vuillamy. Thanks for ongoing works and discussions with: Dominique Attali, Jean-Daniel Boissonnat, Mathijs Wintraecken

Tuesday, February 11, 2020 02:00pm - 03:00pm

Mondi Seminar Room 2, Central Building



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
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<https://ista.ac.at/en/campus/how-to-get-here/> The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.